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Product Manual

# RhoA Activation Assay Kit

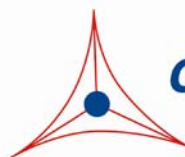
Catalog Number

STA- 403- A

20 assays

**FOR RESEARCH USE ONLY**  
**Not for use in diagnostic procedures**

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**CELL BIOLABS, INC.**

*Creating Solutions for Life Science Research*

## **Introduction**

Small GTP-binding proteins (or GTPases) are a family of proteins that serve as molecular regulators in signaling transduction pathways. RhoA, a 21 kDa protein, regulating a variety of biological response pathways that include cell growth, cell transformation and tumor invasion. Like other small GTPases, RhoA regulates molecular events by cycling between an inactive GDP-bound form and an active GTP-bound form. In its active (GTP-bound) state, RhoA binds specifically to the Rho-binding domain (RBD) of Rhotekin to control downstream signaling cascades.

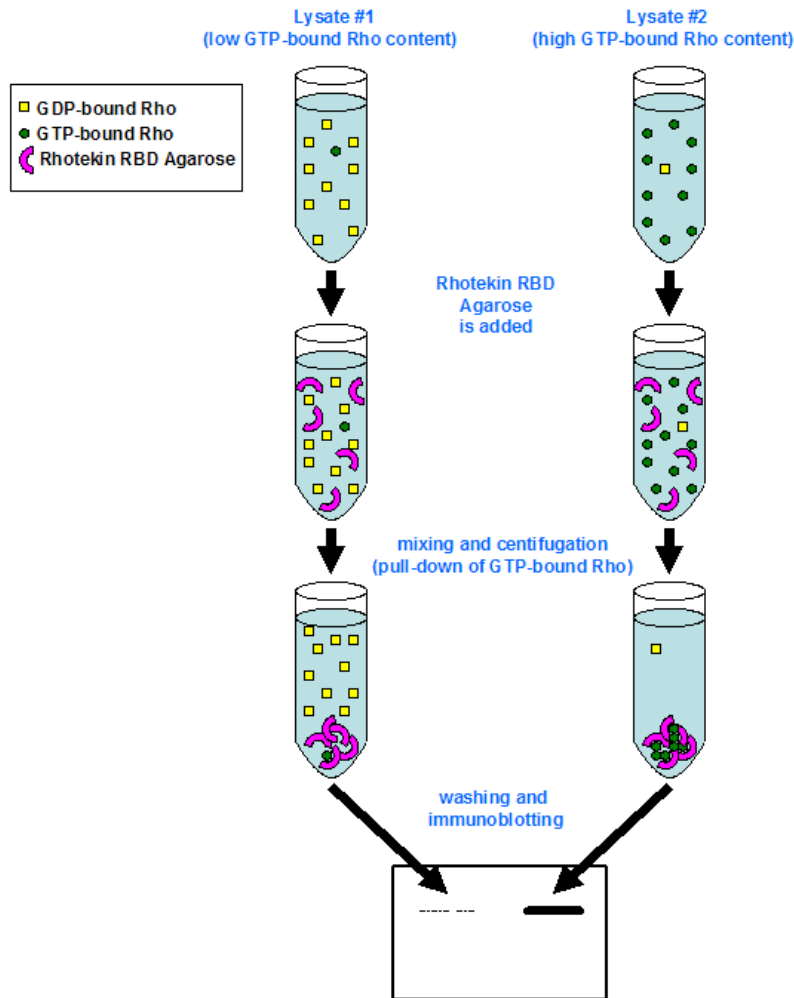
Cell Biolabs' RhoA Activation Assay Kit utilizes Rhotekin RBD Agarose beads to selectively isolate and pull-down the active form of Rho from purified samples or endogenous lysates. Subsequently, the precipitated GTP-Rho is detected by western blot analysis using an anti-RhoA specific monoclonal antibody (see Figure 3 and Assay Principle).

Cell Biolabs' RhoA Activation Assay Kit provides a simple and fast tool to monitor the activation of RhoA. The kit includes easily identifiable Rhotekin RBD Agarose beads (see Figure 1), pink in color, and a RhoA Immunoblot Positive Control for quick RhoA identification. Each kit provides sufficient quantities to perform 20 assays.



**Figure 1:** Rhotekin RBD Agarose beads, in color, are easy to visualize, minimizing potential loss during washes and aspirations.

## Assay Principle



## Related Products

1. STA-400: Pan-Ras Activation Assay Kit
2. STA-400-H: H-Ras Activation Assay Kit
3. STA-400-K: K-Ras Activation Assay Kit
4. STA-400-N: N-Ras Activation Assay Kit
5. STA-401-1: Rac1 Activation Assay
6. STA-401-2: Rac2 Activation Assay
7. STA-403-B: RhoB Activation Assay
8. STA-403-C: RhoC Activation Assay
9. STA-405: RhoA/Rac1/Cdc42 Activation Assay Combo Kit

10. STA-410: Raf1 RBD Agarose Beads
11. STA-457: Ras Expression Vector Set
12. STA-459: Active Ras Expression Vector Set

### **Kit Components**

1. Rhotekin RBD Agarose (Part No. STA-412): One vial – 800  $\mu$ L of 50% slurry, 400  $\mu$ g Rhotekin RBD in PBS containing 50% glycerol.  
*Note: Agarose bead appears pink in color for easy identification, washing, and aspiration.*
2. 100X GTP $\gamma$ S (Part No. 240103): One vial – 50  $\mu$ L of 10 mM GTP $\gamma$ S dissolved in sterile water.
3. 100X GDP (Part No. 240104): One vial – 50  $\mu$ L of 100 mM GDP dissolved in sterile water.
4. 5X Assay/Lysis Buffer (Part No. 240102): One bottle – 30 mL of 125 mM HEPES, pH 7.5, 750 mM NaCl, 5% NP-40, 50 mM MgCl<sub>2</sub>, 5 mM EDTA, 10% Glycerol.
5. Anti-RhoA, Mouse Monoclonal (Part No. 240302): One vial – 40  $\mu$ L in PBS, pH 7.4, 0.05% NaN<sub>3</sub>, 0.1% BSA.  
*Note: This monoclonal antibody specifically reacts with human, mouse, and rat RhoA.*
6. RhoA Immunoblot Positive Control (Part No. 240310): One vial – 100  $\mu$ L of partially purified, recombinant RhoA from *E. coli* (provided ready-to-use in 1X reducing SDS-PAGE Sample Buffer, pre-boiled).

### **Materials Not Supplied**

1. Stimulated and non-stimulated cell lysates
2. RhoA activators
3. Protease inhibitors
4. 0.5 M EDTA in water
5. 1 M MgCl<sub>2</sub>
6. 30°C incubator or water bath
7. 4°C tube rocker or shaker
8. 2X reducing SDS-PAGE sample buffer
9. Electrophoresis and immunoblotting systems
10. Immunoblotting wash buffer such as TBST (10 mM Tris-HCl, pH 7.4, 0.15 M NaCl, 0.05% Tween-20)
11. Immunoblotting blocking buffer (TBST containing 5% Non-fat Dry Milk)
12. PVDF or nitrocellulose membrane
13. Secondary Antibody
14. ECL Detection Reagents

## **Storage**

Store all kit components at -20°C. The 5X Assay/Lysis Buffer may be stored at either -20°C or 4°C. Avoid multiple freeze/thaw cycles.

## **Preparation of Reagents**

- 1X Assay/Lysis Buffer: Mix the 5X Stock briefly and dilute to 1X in deionized water. Just prior to usage, add protease inhibitors such as 1 mM PMSF, 10 µg/mL leupeptin, and 10 µg/mL aprotinin.

## **Preparation of Samples**

*Note: It is advisable to use fresh cell lysates because GTP-RhoA is quickly hydrolyzed to GDP-RhoA; frozen lysates stored at -70°C may be used. Performing steps at 4°C or on ice may reduce hydrolysis. Avoid multiple freeze/thaw cycles of lysates.*

### **I. Adherent Cells**

1. Culture cells to approximately 80-90% confluence. Stimulate cells with RhoA activator(s) as desired.
2. Aspirate the culture media and wash twice with ice-cold PBS.
3. Completely remove the final PBS wash and add ice-cold 1X Assay/Lysis Buffer to the cells (0.5 - 1 mL per 100 mm tissue culture plate).
4. Place the culture plates on ice for 10-20 minutes.
5. Detach the cells from the plates by scraping with a cell scraper.
6. Transfer the lysates to appropriate size tubes and place on ice.
7. If nuclear lysis occurs, the cell lysates may become very viscous and difficult to pipette. If this occurs, lysates can be passed through a 27½-gauge syringe needle 3-4 times to shear the genomic DNA.
8. Clear the lysates by centrifugation for 10 minutes (14,000 x g at 4°C).
9. Collect the supernatant and store samples on ice for immediate use, or snap freeze and store at -70°C for future use.
10. Proceed to GTPγS/GDP Loading for positive and negative controls, or Pull-Down Assay.

### **II. Suspension Cells**

1. Culture cells and stimulate with RhoA activator(s) as desired.
2. Perform a cell count, and then pellet the cells by centrifugation.
3. Aspirate the culture media and wash twice with ice-cold PBS.
4. Completely remove the final PBS wash and add ice-cold 1X Assay/Lysis Buffer to the cell pellet (0.5 – 1 mL per  $1 \times 10^7$  cells).
5. Lyse the cells by repeated pipetting.

6. Transfer the lysates to appropriate size tubes and place on ice.
7. If nuclear lysis occurs, the cell lysates may become very viscous and difficult to pipette. If this occurs, lysates can be passed through a 27½-gauge syringe needle 3-4 times to shear the genomic DNA.
8. Clear the lysates by centrifugation for 10 minutes (14,000 x g at 4°C).
9. Collect the supernatant and store samples on ice for immediate use, or snap freeze and store at -70°C for future use.
10. Proceed to GTPγS/GDP Loading for positive and negative controls, or Pull-Down Assay.

## **Assay Protocol**

*Important Note: Before running any Small GTPase pulldown assay, it is always a good practice to run a Western Blot directly on the cell lysate using the antibody provided in this kit. For example: load 5 μg, 10 μg and 20 μg of lysate onto an SDS-PAGE gel, transfer and blot. When proceeding with the pulldown assay, use 100-times the amount of lysate that gave you a clear band of your desired small GTPase in the direct Western blot. For example: if the 5 μg band was faint but the 10 μg band was clear and strong, use 100 x 10 μg = 1 mg of lysate in the assay. Using sufficient lysate in the pulldown assay is critical to success.*

### **I. GTPγS/GDP Loading (Positive and Negative Controls)**

*Note: Samples that will not be GTPγS/GDP loaded may be kept on ice during the loading of controls.*

1. Aliquot 0.5 – 1 mL of each cell lysate to two microcentrifuge tubes.  
*Note: Typical protein content/sample is > 0.5 mg.*
2. Adjust the volume of each sample to 1 mL with 1X Assay Lysis Buffer.
3. Add 20 μL of 0.5 M EDTA to each sample.
4. Add 10 μL of 100X GTPγS to one tube (positive control) and 10 μL of 100X GDP to the other tube (negative control). Mix and label each tube appropriately.
5. Incubate the tubes for 30 minutes at 30°C with agitation.
6. Stop the loading by adding 65 μL of 1 M MgCl<sub>2</sub> to each tube. Mix and place tubes on ice.
7. Continue with Pull-Down assay.

### **II. RhoA Pull-Down Assay**

1. Aliquot 0.5 – 1 mL of cell lysate (treated with RhoA activators or untreated) to a microcentrifuge tube.
2. Adjust the volume of each sample to 1 mL with 1X Assay Lysis Buffer.
3. Thoroughly resuspend the Rhotekin RBD Agarose bead slurry by vortexing or titrating.
4. Quickly add 40 μL of resuspended bead slurry to each tube (including GTPγS/GDP controls).
5. Incubate the tubes at 4°C for 1 hour with gentle agitation.
6. Pellet the beads by centrifugation for 10 seconds at 14,000 x g.

7. Aspirate and discard the supernatant, making sure not to disturb/remove the bead pellet.
8. Wash the bead 3 times with 0.5 mL of 1X Assay Buffer, centrifuging and aspirating each time.
9. After the last wash, pellet the beads and carefully remove all the supernatant.
10. Resuspend the bead pellet in 40  $\mu$ L of 2X reducing SDS-PAGE sample buffer.
11. Boil each sample for 5 minutes.
12. Centrifuge each sample for 10 seconds at 14,000 x g.

### III. Electrophoresis and Transfer

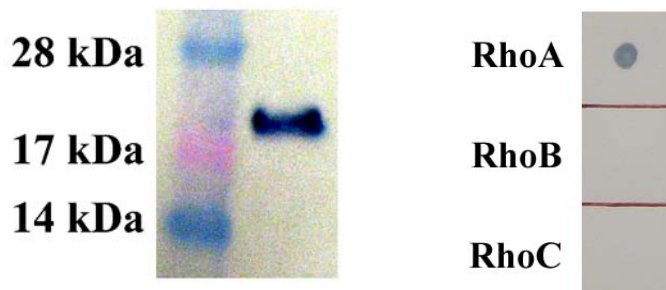
1. Load 20  $\mu$ L/well of pull-down supernatant to a polyacrylamide gel. Also, it's recommended to include a pre-stained MW standard (as an indicator of a successful transfer in step 3).  
*Note: If desired, 10  $\mu$ L/well of RhoA Immunoblot Positive Control (provided ready-to-use, pre-boiled) can be added as an immunoblot positive control.*
2. Perform SDS-PAGE as per the manufacturer's instructions.
3. Transfer the gel proteins to a PVDF or nitrocellulose membrane as per the manufacturer's instructions.

### IV. Immunoblotting and Detection (all steps are at room temperature, with agitation)

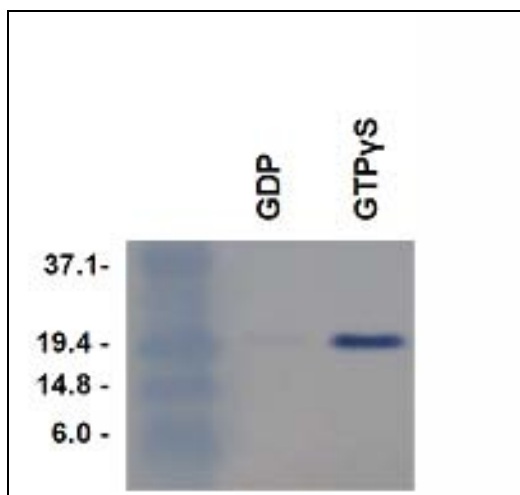
1. Following the electroblotting step, immerse the PVDF membrane in 100% Methanol for 15 seconds, and then allow it to dry at room temperature for 5 minutes.  
*Note: If Nitrocellulose is used instead of PVDF, this step should be skipped.*
2. Block the membrane with 5% non-fat dry milk in TBST for 1 hr at room temperature with constant agitation.  
Incubate the membrane with Anti-RhoA Antibody, freshly diluted 1:200 to 1:1000 in 5% non-fat dry milk/TBST, for 1-2 hr at room temperature with constant agitation.  
*Note: To conserve antibody, incubations should be performed in a plastic bag.*
3. Wash the blotted membrane three times with TBST, 5 minutes each time.
4. Incubate the membrane with a secondary antibody (e.g. Goat Anti-Mouse IgG, HRP-conjugate), freshly diluted in 5% non-fat dry milk/TBST, for 1 hr at room temperature with constant agitation.
5. Wash the blotted membrane three times with TBST, 5 minutes each time.
6. Use the detection method of your choice. We recommend enhanced chemiluminescence reagents from Pierce.

## Example of Results

The following figure demonstrates typical results seen with Cell Biolabs RhoA Activation Assay Kit. One should use the data below for reference only.



**Figure 2: RhoA Activation Assay.** *Left Image:* RhoA Immunoblot Positive Control. *Right Image:* Demonstrates Anti-RhoA monoclonal antibody specificity by dot blot.



**Figure 3: RhoA Activation Assay.** *Lane 1:* MW Standard. *Lane 2:* MDA-231 cell lysate loaded with GDP and incubated with Rhotekin RBD Agarose beads. *Lane 3:* MDA-231 cell lysate loaded with GTP $\gamma$ S and incubated with Rhotekin RBD Agarose beads.

## References

1. Ren X.D. and Schwartz M. A. (2000) *Methods Enzymol.* **325**, 264-72.

## Recent Product Citations

1. Ye, Y. et al. (2016). Down-regulation of 14-3-3 Zeta Inhibits TGF- $\beta$ 1-Induced Actomyosin Contraction in Human Trabecular Meshwork Cells Through RhoA Signaling Pathway. *Invest Ophthalmol Vis Sci.* **57**(2):719-30. doi: 10.1167/iops.15-17438.



2. Ma, J. H. et al. (2016). The role of IRE-XBP1 pathway in regulation of retinal pigment epithelium tight junctions XBP1 regulates the RPE tight junctions. *Invest Ophthalmol Vis Sci.* **57**:5244-5252.
3. Kim, J. M. et al. (2016). Distinctive and selective route of PI3K/PKC $\alpha$ -PKC $\delta$ /RhoA-Rac1 signaling in osteoclastic cell migration. *Mol Cell Endocrinol.* doi:10.1016/j.mce.2016.08.042.
4. Cui, J. et al. (2016). Epigenetic silencing of TPM2 contributes to colorectal cancer progression upon RhoA activation. *Tumor Biol.* doi:10.1007/s13277-016-5103-1.
5. Ye, Y. et al. (2016). Down-regulation of 14-3-3 Zeta inhibits TGF- $\beta$ 1-induced actomyosin contraction in human trabecular meshwork cells through rhoa signaling pathway 14-3-3 zeta regulates actomyosin contraction in TM cells. *Invest Ophthalmol Vis Sci.* **57**:719-730.
6. Gayle, S. et al. (2015). piggyBac insertional mutagenesis screen identifies a role for nuclear RhoA in human ES cell differentiation. *Stem cell Reports.* doi:10.1016/j.stemcr.2015.03.001.
7. Choi, D. S. et al. (2015). SDF-1 $\alpha$  stiffens myeloma bone marrow mesenchymal stromal cells through the activation of RhoA-ROCK-Myosin II. *Int J Cancer.* **136**:E219-E229.
8. Schmidt, L. & Carrillo-Sepulveda, M. A. (2015). Toll-like receptor 2 mediates vascular contraction and activates RhoA signaling in vascular smooth muscle cells from STZ-induced type 1 diabetic rats. *Pflügers Arch.* doi: 10.1007/s00424-015-1688-2.
9. Fujita, M. et al. (2014). Nitric oxide increases the invasion of pancreatic cancer cells via activation of the PI3K-AKT and RhoA pathways after carbon ion irradiation. *FEBS Lett.* **588**:3240-3250.
10. Tripathi, V. et al. (2014). DLC1 suppresses NF- $\kappa$ B activity in prostate cancer cells due to its stabilizing effect on adherens junctions. *Springerplus.* **3**:27.
11. Kwak, S. Y. et al. (2014). Ionizing radiation-inducible miR-494 promotes glioma cell invasion through EGFR stabilization by targeting p190B RhoGAP. *Biochim Biophys Acta.* **1843**:508-516.
12. Cao, X. et al. (2014). Resveratrol prevents AngII-induced hypertension via AMPK activation and RhoA/ROCK suppression in mice. *Hypertens Res.* **37**:803-810.
13. Yanagishita, T. et al. (2014) Actin-binding protein, espin: a novel metastatic regulator for melanoma. *Mol. Cancer Res.* **12**:440-446.
14. Fiuza, M. et al. (2013). GluN3A expression restricts spine maturation via inhibition of GIT1/Rac1 signaling. *PNAS.* **110**:20807-20812.
15. Basu, M. et al. (2012). Wnt/ $\beta$ -catenin pathway is regulated by PITX2 homeodomain protein and thus contributes to the proliferation of human ovarian adenocarcinoma cell, SKOV-3. *J. Biol. Chem.* **288**:4355-4367.
16. Tripathi, V. et al. (2012). DLC1 interaction with  $\alpha$ -catenin stabilizes adherens junctions and enhances DLC1 antioncogenic activity. *Mol. Cell. Biol.* **32**:2145-2159.
17. Chen, H. et al. (2010). Integrity of SOS1/EPS8/ABI1 tri-complex determines ovarian cancer metastasis. *Cancer Res.* **70**:9979-9990.
18. Hayes, N.V.L. et al. (2010). Expression of neuregulin 4 splice variants in normal human tissues and prostate cancer and their effects on cell motility. *Endocr. Relat. Cancer.* **18**:39-49.
19. Godin, C.M. et al. (2010). The angiotensin II Type 1 receptor induces membrane blebbing by coupling to Rho A, Rho Kinase, and Myosin Light Chain Kinase. *Mol. Pharmacol.* **77**:903-911.

## **Warranty**

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